

**WHAT IS CLAIMED IS:**

1. A method for restoring a virtual path in an optical network, the method comprising:

- 5       broadcasting a plurality of resource request packets to a  
           plurality of nodes in said optical network;  
       identifying a plurality of nodes with resources wherein said  
           nodes with resources are ones of said nodes having a  
           resource necessary to support said virtual path;  
 10       determining an alternate physical path, said alternate physical  
           path comprising ones of said nodes with resources;  
       configuring said alternate physical path by establishing a  
           communication connection between said ones of said  
           nodes with resources; and  
 15       restoring said virtual path by provisioning said virtual path over  
           said alternate physical path.

2. The method of claim 1, further comprising:  
       detecting a failure in said virtual path;

3. The method of claim 2, wherein:  
 20       said detection of said failure is done by receiving a failure  
           message packet;  
       said identification of said nodes with resources is done by  
           acknowledging said failure message packet; and  
       said determination of said nodes with resources is done by  
 25       analyzing a response to said resource request packets.

4. The method of claim 2, wherein:  
 said virtual path is provisioned on a physical path between a  
 first and a second node of said optical network;  
 said optical network comprises said nodes; and  
 5 each one of said nodes is coupled to at least one another of said  
 nodes by a plurality of optical links.

5. The method of claim 4, wherein:  
 said physical path between said first and said second node  
 comprises a plurality of intermediate nodes.

10 6. The method of claim 4, wherein each one of said nodes is coupled to at  
 least one another of said nodes in a mesh topology.

7. The method of claim 6, wherein said restoring of said virtual path is  
 completed in less than 2 seconds.

15 8. The method of claim 6, wherein said restoring of said virtual path is  
 completed in less than 250 milliseconds.

9. The method of claim 6, wherein said restoring of said virtual path is  
 completed in less than 50 milliseconds.

10. The method of claim 6, wherein said restoring of said virtual path by is  
 performed by said first node.

20 11. The method of claim 10, further comprising:  
 if said failure is a local physical port failure between said first  
 node and an adjacent node,  
 determining an available different physical port of said  
 link between said first node and said adjacent  
 25 nodes,

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initiating a physical port switch request for said adjacent  
node,  
provisioning said virtual path to said different physical  
port, and  
5 updating said provisioning information in a node  
database.

12. The method of claim 11, further comprising:  
if different physical port of said link between said first node  
and said adjacent nodes is unavailable,  
10 (i) changing a state of said virtual path to restoring,  
(ii) identifying a plurality of adjacent nodes with  
required bandwidth for said virtual path,  
(iii) forwarding a path restoration request to said  
plurality of adjacent nodes with required bandwidth  
15 for said virtual path, and  
(iv) waiting for a response for said path restoration  
request for a first predetermined time interval.

13. The method of claim 12, further comprising:  
if said response to said path restoration request is not received  
20 within said first predetermined time interval,  
repeating steps (ii) – (iv) for a second predetermined  
time interval.

14. The method of claim 13, further comprising:  
if said response is not receive in within said second  
25 predetermined time interval,  
generating network alarms.

15. The method of claim 14, wherein said first and said second  
predetermined time intervals are defined during provisioning of said virtual path.

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16. The method of claim 14, wherein said first and said second predetermined time intervals are dynamically calculated by said network based on network traffic condition.

17. The method of claim 10, further comprising:  
 5 if said failure did not occur at a physical port of said link  
 between said first node and one of adjacent nodes of  
 said first node,  
 (i) changing a state of said virtual path to restoring,  
 (ii) identifying a plurality of adjacent nodes with  
 10 required bandwidth for said virtual path,  
 (iii) forwarding a path restoration request to said  
 plurality of adjacent nodes with required bandwidth  
 for said virtual path, and  
 (iv) waiting for a response for said path restoration  
 15 request for a first predetermined time interval.

18. The method of claim 17, further comprising:  
 if said response for said path restoration request is not receive  
 within said first predetermined time interval,  
 repeating steps (ii) – (iv) for a second predetermined  
 20 time interval.

19. The method of claim 18, further comprising:  
 if said response for said path restoration request is not received  
 with in said second predetermined time interval,  
 generating network alarms.

20. The method of claim 19, wherein said first and said second  
 25 predetermined time intervals are defined during provisioning of said virtual path.

21. The method of claim 19, wherein said first and said second predetermined time intervals are dynamically calculated by said network based on network traffic condition.

22. The method of claim 6, wherein said restoring of said virtual path is performed by one of said intermediate nodes.

23. The method of claim 22, wherein said failure is a local physical port failure between said intermediary node and an adjacent node comprising said virtual path.

24. The method of claim 23, further comprising:  
determining an available different physical port of said link  
between said intermediary node and said adjacent  
nodes;  
initiating a physical port switch request for said adjacent node;  
provisioning said virtual path to said different physical port;  
and  
updating said provisioning information in a node database.

25. The method of claim 24, further comprising:  
if different physical port of said link between said intermediary  
node and said adjacent nodes is unavailable,  
a. changing a state of said virtual path to down,  
b. generating a restoration request,  
c. forwarding said restoration request to a plurality of  
adjacent nodes comprising said virtual path, and  
d. waiting for a response to said restoration request for  
a predetermined interval of time.

26. The method of claim 25, further comprising:  
if said response to said restoration request is not received  
within said predetermined interval of time,  
repeating steps (b) – (d) for a predefined threshold  
5 times.

27. The method of claim 26, further comprising:  
if said response to said restoration request is not received  
within said predefined threshold times,  
releasing resources of said virtual path.

10 28. The method of claim 27, wherein said predetermined interval of time  
and said predefined threshold are defined during provisioning of said virtual path.

29. The method of claim 27, wherein said predetermined interval of time  
and said predefined threshold are dynamically calculated by said network based on  
network traffic condition.

15 30. The method of claim 26, further comprising:  
if said response to said restoration request is received,  
releasing resources of said virtual path.

31. The method of claim 22, further comprising:  
if said intermediary node receives a message of a remote port  
20 failure at a node comprising said virtual path,  
changing a state of said virtual path to down,  
forwarding said message to a plurality of adjacent nodes  
comprising said virtual path, and  
initiating a timer for receiving a response to said  
25 forwarded message.

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32. The method of claim 31, further comprising:  
if said timer expires before said response to said forwarded  
message is received,  
releasing resources of said virtual path.

5 33. The method of claim 31, further comprising:  
if said response to said forwarded message is received,  
releasing resources of said virtual path.

34. The method of claim 22, further comprising:  
if said intermediary node receives a valid restore path request,  
10 updating path information in a node database,  
allocating resources requested for said virtual path, and  
forwarding said restore path request to all eligible  
adjacent nodes.

35. The method of claim 22, further comprising:  
15 if said intermediary node receives an invalid restore path  
request,  
responding with a negative acknowledgment.

36. The method of claim 6, wherein restoring of said virtual path is  
performed by said second node.

20 37. The method of claim 36, further comprising:  
if said failure is a local physical port failure between said  
second node and an adjacent node comprising said  
virtual path,  
determining an available different physical port of said  
25 link between said second node and said adjacent  
nodes,

initiating a physical port switch request for said adjacent  
node,  
provisioning said virtual path to said different physical  
port, and  
5 updating said provisioning information in a node  
database.

38. The method of claim 37, further comprising:  
if different physical port of said link between said second node  
and said adjacent nodes is unavailable,  
10 a. changing a state of said virtual path to down,  
b. generating a restoration request,  
c. forwarding said restoration request to a plurality of  
adjacent nodes comprising said virtual path, and  
d. waiting for a response to said restoration request for  
15 a predetermined interval of time.

39. The method of claim 38, further comprising:  
if said response to said restoration request is not received  
within said predetermined interval of time,  
repeating steps (b) – (d) for a predefined threshold  
20 times.

40. The method of claim 39, further comprising:  
if said response to said restoration request is not received  
within said predefined threshold times,  
releasing resources of said virtual path.

41. The method of claim 40, wherein said predetermined interval of time  
and said predefined threshold are defined during provisioning of said virtual path.

42. The method of claim 40, wherein said predetermined interval of time and said predefined threshold are dynamically calculated by said network based on network traffic condition.

5 43. The method of claim 39, further comprising:  
if said response to said restoration request is received,  
releasing resources of said virtual path.

10 44. The method of claim 36, further comprising:  
if said second node receives a message of a remote port failure  
at a node comprising said virtual path,  
acknowledging said message,  
changing a state of said virtual path to down, and  
releasing resources of said virtual path.

15 45. The method of claim 36, further comprising:  
if said second node receives a valid restore path request,  
updating path information in a node database, and  
allocating resources requested for said virtual path.

46. The method of claim 36, further comprising:  
if said second node receives an invalid restore path request,  
responding with a negative acknowledgment.

20 47. A computer system comprising:  
a processor;  
an optical network interface, coupled to said processor and to  
an optical network;  
computer readable medium coupled to said processor; and  
25 computer code, encoded in said computer readable medium,  
configured to cause said processor to:  
broadcast a plurality of resource request packets to a  
plurality of said nodes in said optical network;

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identify a plurality of nodes with resources wherein said  
nodes with resources are ones of said nodes  
having a resource necessary to support said  
virtual path;  
5 determine an alternate physical path, said alternate  
physical path comprising ones of said nodes  
with resources;  
configure said alternate physical path by establishing a  
communication connection between said ones of  
10 said nodes with resources; and  
restore said virtual path by provisioning said virtual  
path over said alternate physical path.

48. The computer system of claim 47, wherein said computer code  
configured to cause said processor to:  
15 detect a failure in said virtual path.

49. The computer system of claim 47, wherein said computer code  
configured to cause said processor to restore said virtual path is further configured to  
cause said processor to:  
complete restoration of said virtual path in less than 50  
20 milliseconds.

50. The computer system of claim 47, wherein:  
said virtual path is provisioned on a physical path between a  
first and a second node of said optical network;  
said optical network comprises said nodes; and  
25 each one of said nodes is coupled to at least one another of said  
nodes by a plurality of optical links.

51. The computer system of claim 50, wherein:  
said physical path between said first and said second node  
comprises a plurality of intermediate nodes.

52. The computer system of claim 50, wherein each one of said nodes is  
5 coupled to at least one another of said nodes in a mesh topology.

53. The computer system of claim 52, wherein said computer code is  
configured to cause said processor to perform said restoring of said virtual path at said  
first node.

54. The computer system of claim 53, wherein said computer code  
10 configured to cause said processor to:  
if said failure is a local physical port failure between said first  
node and an adjacent node,  
determine an available different physical port of said  
link between said first node and said adjacent  
15 nodes,  
initiate a physical port switch request for said adjacent  
node,  
provision said virtual path to said different physical  
port, and  
20 update said provisioning information in a node  
database.

55. The computer system of claim 54, wherein said computer code  
configured to cause said processor to:  
if different physical port of said link between said first node  
25 and said adjacent nodes is unavailable,  
(i) change a state of said virtual path to restoring,  
(ii) identify a plurality of adjacent nodes with required  
bandwidth for said virtual path,

- (iii)forward a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and
- (iv)wait for a response for said path restoration request for a first predetermined time interval.

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56. The computer system of claim 55, wherein said computer code configured to cause said processor to:

- if said response to said path restoration request is not received within said first predetermined time interval,
- repeat steps (ii) – (iv) for a second predetermined time interval.

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57. The computer system of claim 56, wherein said computer code configured to cause said processor to:

- if said response is not receive in within said second predetermined time interval,
- generate network alarms.

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58. The computer system of claim 53, wherein said computer code configured to cause said processor to:

- if said failure did not occur at a physical port of said link between said first node and one of adjacent nodes of said first node,
- (i) change a state of said virtual path to restoring,
- (ii) identify a plurality of adjacent nodes with required bandwidth for said virtual path,
- (iii)forward a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and
- (iv)wait for a response for said path restoration request for a first predetermined time interval.

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59. The computer system of claim 58, wherein said computer code configured to cause said processor to:

if said response for said path restoration request is not receive  
within said first predetermined time interval,  
5 repeat steps (ii) – (iv) for a second predetermined time  
interval.

60. The computer system of claim 59, wherein said computer code configured to cause said processor to:

if said response for said path restoration request is not received  
10 with in said second predetermined time interval,  
generate network alarms.

61. The computer system of claim 52, wherein said computer code configured to cause said processor to perform said restoring of said virtual path at one of said intermediate nodes.

15 62. The computer system of claim 61, wherein said computer code configured to cause said processor to:

if said failure is a local physical port failure between said  
intermediary node and an adjacent node comprising said  
virtual path,  
20 determine an available different physical port of said  
link between said intermediary node and said  
adjacent nodes,  
initiate a physical port switch request for said adjacent  
node,  
25 provision said virtual path to said different physical  
port, and  
update said provisioning information in a node  
database.

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63. The computer system of claim 62, wherein said computer code configured to cause said processor to:

if different physical port of said link between said intermediary

node and said adjacent nodes is unavailable,

- 5 a. change a state of said virtual path to down,
- b. generate a restoration request,
- c. forward said restoration request to a plurality of adjacent nodes comprising said virtual path, and
- 10 d. wait for a response to said restoration request for a predetermined interval of time.

64. The computer system of claim 63, wherein said computer code configured to cause said processor to:

if said response to said restoration request is not received

within said predetermined interval of time,

- 15 repeat steps (b) – (d) for a predefined threshold times.

65. The computer system of claim 64, wherein said computer code configured to cause said processor to:

if said response to said restoration request is not received

within said predefined threshold times,

- 20 release resources of said virtual path.

66. The computer system of claim 64, wherein said computer code configured to cause said processor to:

if said response to said restoration request is received,

release resources of said virtual path.

67. The computer system of claim 61, wherein said computer code configured to cause said processor to:

if said intermediary node receives a message of a remote port

failure at a node comprising said virtual path,

change a state of said virtual path to down,

forward said message to a plurality of adjacent nodes  
comprising said virtual path, and  
initiate a timer for receiving a response to said  
forwarded message.

5           68.    The computer system of claim 67, wherein said computer code  
configured to cause said processor to:

if said timer expires before said response to said forwarded  
message is received,  
release resources of said virtual path.

10           69.    The computer system of claim 67, wherein said computer code  
configured to cause said processor to:

if said response to said forwarded message is received,  
release resources of said virtual path.

15           70.    The computer system of claim 61, wherein said computer code  
configured to cause said processor to:

if said intermediary node receives a valid restore path request,  
update path information in a node database,  
allocate resources requested for said virtual path, and  
forward said restore path request to all eligible adjacent  
20                   nodes.

71.    The computer system of claim 61, wherein said computer code  
configured to cause said processor to:

if said intermediary node receives an invalid restore path  
request,  
25                   respond with a negative acknowledgment.

72.    The computer system of claim 52, wherein said computer code  
configured to cause said processor to perform said restoring of said virtual path at said  
second node.

73. The computer system of claim 72, wherein said computer code configured to cause said processor to:

if said failure is a local physical port failure between said second node and an adjacent node comprising said virtual path,  
determine an available different physical port of said link between said second node and said adjacent nodes,  
initiate a physical port switch request for said adjacent node,  
provision said virtual path to said different physical port, and  
update said provisioning information in a node database.

74. The computer system of claim 73, wherein said computer code configured to cause said processor to:

if different physical port of said link between said second node and said adjacent nodes is unavailable,  
a. change a state of said virtual path to down,  
b. generate a restoration request,  
c. forward said restoration request to a plurality of adjacent nodes comprising said virtual path, and  
d. wait for a response to said restoration request for a predetermined interval of time.

75. The computer system of claim 72, wherein said computer code configured to cause said processor to:

if said response to said restoration request is not received within said predetermined interval of time,  
repeat steps (b) – (d) for a predefined threshold times.

76. The computer system of claim 75, wherein said computer code configured to cause said processor to:

if said response to said restoration request is not received  
within said predefined threshold times,  
release resources of said virtual path.

77. The computer system of claim 75, wherein said computer code configured to cause said processor to:

if said response to said restoration request is received,  
release resources of said virtual path.

78. The computer system of claim 72, wherein said computer code configured to cause said processor to:

if said second node receives a message of a remote port failure  
at a node comprising said virtual path,  
acknowledge said message,  
change a state of said virtual path to down, and  
release resources of said virtual path.

79. The computer system of claim 72, wherein said computer code configured to cause said processor to:

if said second node receives a valid restore path request,  
update path information in a node database, and  
allocate resources requested for said virtual path.

80. The computer system of claim 72, wherein said computer code configured to cause said processor to:

if said second node receives an invalid restore path request,  
respond with a negative acknowledgment.

81. A computer program product encoded in computer readable media, said program product comprising:

- a first set of instructions executable on a computer system,  
configured to broadcast a plurality of resource request  
packets to a plurality of nodes in an optical network;
- a second set of instructions executable on said computer  
system, configured to identify a plurality of nodes with  
resources wherein said nodes with resources are ones of  
said nodes having a resource necessary to support said  
virtual path;
- a third set of instructions executable on said computer system,  
configured to determine an alternate physical path, said  
alternate physical path comprising ones of said nodes  
with resources;
- a fourth set of instructions executable on said computer system,  
configured to configure said alternate physical path by  
establishing a communication connection between said  
ones of said nodes with resources; and
- a fifth set of instructions executable on said computer system,  
configured to restore said virtual path by provisioning  
said virtual path over said alternate physical path.

82. The computer program product of claim 81, further comprising:

- a sixth set of instruction executable on said computer system,  
configured to detect a failure in said virtual path in said  
optical system.

83. The computer program product of claim 81, wherein said first set of instruction comprises:

- a first sub-set of instructions, executable on said computer  
system, configured to receive a failure message packet;

a second sub-set of instructions, executable on said computer system, configured to analyze said failure message packet; and

5 a third sub-set of instructions, executable on said computer system, configured to identify if said failure is a local failure.

84. The computer program product of claim 81, wherein:  
said virtual path is provisioned on a physical path between a first and a second node of said optical network,  
10 said physical path comprises a plurality of intermediate nodes, each one of said nodes is coupled to at least on another of said nodes in a mesh topology.

85. The computer program product of claim 84, wherein said restoring of said virtual path is performed by said first node.

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15 86. The computer program product of claim 85, further comprising:  
a sixth set of instructions executable on said computer system, configured to:  
if said failure is a local physical port failure between said first node and an adjacent node,  
20 determine an available different physical port of said link between said first node and said adjacent nodes,  
initiate a physical port switch request for said adjacent node,  
25 provision said virtual path to said different physical port, and  
update said provisioning information in a node database.

87. The computer program product of claim 86, further comprising:  
a seventh set of instructions executable on said computer  
system, configured to:

if different physical port of said link between said first node

5 and said adjacent nodes is unavailable,

(i) change a state of said virtual path to restoring,

(ii) identify a plurality of adjacent nodes with required  
bandwidth for said virtual path,

(iii) forward a path restoration request to said plurality of  
10 adjacent nodes with required bandwidth for said virtual  
path, and

(iv) wait for a response for said path restoration request for a  
first predetermined time interval.

88. The computer program product of claim 87, further comprising:  
15 an eighth set of instructions executable on said computer  
system, configured to:

if said response to said path restoration request is not received  
within said first predetermined time interval,

20 repeat steps (ii) – (iv) for a second predetermined time  
interval.

89. The computer program product of claim 86, further comprising:  
a ninth set of instructions executable on said computer system,  
configured to:

25 if said response is not received within said second  
predetermined time interval,  
generate network alarms.

90. The computer program product of claim 85, further comprising:  
a sixth set of instructions executable on said computer system,  
configured to:

if said failure did not occur at a physical port of said link  
between said first node and one of adjacent nodes of  
said first node,

- 5 (i) changing a state of said virtual path to restoring,  
(ii) identifying a plurality of adjacent nodes with  
required bandwidth for said virtual path,  
(iii) forwarding a path restoration request to said  
plurality of adjacent nodes with required  
bandwidth for said virtual path, and  
10 (iv) waiting for a response for said path restoration  
request for a first predetermined time interval.

91. The computer program product of claim 90, further comprising:  
a seventh set of instructions executable on said computer  
system, configured to:

- 15 if said response for said path restoration request is not receive  
within said first predetermined time interval,  
repeat steps (ii) – (iv) for a second predetermined time  
interval.

92. The computer program product of claim 90, further comprising:  
an eighth set of instructions executable on said computer  
system, configured to:

- 20 if said response for said path restoration request is not received  
with in said second predetermined time interval,  
generate network alarms.

25 93. The computer program product of claim 84, wherein said restoring of  
said virtual path is performed by one of said intermediate nodes.

94. The computer program product of claim 93, further comprising:  
a sixth set of instructions executable on said computer system,  
configured to:

if said failure is a local port failure between said intermediary  
 node and an adjacent node comprising said virtual path,  
 determine an available different physical port of said  
 link between said intermediary node and said  
 5 adjacent nodes,  
 initiate a physical port switch request for said adjacent  
 node,  
 provision said virtual path to said different physical  
 port, and  
 10 updat said provisioning information in a node database.

95. The computer program product of claim 94, further comprising:  
 a seventh set of instructions executable on said computer  
 system, configured to:

if different physical port of said link between said intermediary  
 15 node and said adjacent nodes is unavailable,  
 a. change a state of said virtual path to down,  
 b. generate a restoration request,  
 c. forward said restoration request to a plurality of  
 adjacent nodes comprising said virtual path, and  
 20 d. wait for a response to said restoration request for a  
 predetermined interval of time.

96. The computer program product of claim 95, further comprising:  
 an eighth set of instructions executable on said computer  
 system, configured to:

25 if said response to said restoration request is not received  
 within said predetermined interval of time,  
 repeat steps (b) – (d) for a predefined threshold times.

97. The computer program product of claim 96, further comprising:  
 a ninth set of instructions executable on said computer system,  
 30 configured to:

if said response to said restoration request is not received  
 within said predefined threshold times,  
 release resources of said virtual path.

98. The computer program product of claim 97, further comprising:  
 a tenth set of instructions executable on said computer system,  
 configured to:  
 if said response to said restoration request is received,  
 release resources of said virtual path.

99. The computer program product of claim 93, further comprising:  
 a sixth set of instructions executable on said computer system,  
 configured to:  
 if said intermediary node receives a message of a remote port  
 failure at a node comprising said virtual path,  
 change a state of said virtual path to down,  
 forward said message to a plurality of adjacent nodes  
 comprising said virtual path, and  
 initiate a timer for receiving a response to said  
 forwarded message.

100. The computer program product of claim 99, further comprising:  
 a seventh set of instructions executable on said computer  
 system, configured to:  
 if said timer expires before said response to said forwarded  
 message is received,  
 release resources of said virtual path.

101. The computer program product of claim 100, further comprising:  
 an eighth set of instructions executable on said computer  
 system, configured to:  
 if said response to said forwarded message is received,  
 release resources of said virtual path.

102. The computer program product of claim 93, further comprising:

a sixth set of instructions executable on said computer system,

configured to:

if said intermediary node receives a valid restore path request,

updating path information in a node database,

allocating resources requested for said virtual path, and

forwarding said restore path request to all eligible

adjacent nodes.

103. The computer program product of claim 93, further comprising:

a sixth set of instructions executable on said computer system,

configured to:

if said intermediary node receives an invalid restore path

request,

respond with a negative acknowledgment.

104. The computer program product of claim 84, wherein said restoring of said virtual path is performed by said second node.

105. The computer program product of claim 104, further comprising:

a sixth set of instructions executable on said computer system,

configured to:

if said failure is a local physical port failure between said

second node and an adjacent node comprising said

virtual path,

determine an available different physical port of said

link between said second node and said adjacent

nodes,

initiate a physical port switch request for said adjacent

node,

provision said virtual path to said different physical

port, and

update said provisioning information in a node  
database.

106. The computer program product of claim 105, further comprising:  
a seventh set of instructions executable on said computer  
5 system, configured to:

if different physical port of said link between said second node  
and said adjacent nodes is unavailable,  
a. change a state of said virtual path to down,  
b. generate a restoration request,  
10 c. forward said restoration request to a plurality of  
adjacent nodes comprising said virtual path, and  
d. wait for a response to said restoration request for a  
predetermined interval of time.

107. The computer program product of claim 106, further comprising:  
15 an eighth set of instructions executable on said computer  
system, configured to:  
if said response to said restoration request is not received  
within said predetermined interval of time,  
repeat steps (b) – (d) for a predefined threshold times.

108. The computer program product of claim 107, further comprising:  
20 a ninth set of instructions executable on said computer system,  
configured to:  
if said response to said restoration request is not received  
within said predefined threshold times,  
25 release resources of said virtual path.

109. The computer program product of claim 107, further comprising:  
a ninth set of instructions executable on said computer system,  
configured to:  
if said response to said restoration request is received,  
30 release resources of said virtual path.

110. The computer program product of claim 104, further comprising:  
a sixth set of instructions executable on said computer system,  
configured to:

if said second node receives a message of a remote port failure  
at a node comprising said virtual path,  
acknowledge said message,  
change a state of said virtual path to down, and  
release resources of said virtual path.

111. The computer program product of claim 104, further comprising:  
a sixth set of instructions executable on said computer system,  
configured to:

if said second node receives a valid restore path request,  
update path information in a node database, and  
allocate resources requested for said virtual path.

112. The computer program product of claim 104, further comprising:  
a sixth set of instructions executable on said computer system,  
configured to:

if said second node receives an invalid restore path request,  
respond with a negative acknowledgment.

113. A computer system comprising:  
means for broadcasting a plurality of resource request packets  
to a plurality of nodes in an optical network;

means for identifying a plurality of nodes with resources  
wherein said nodes with resources are ones of said  
nodes having a resource necessary to support a virtual  
path;

means for determining an alternate physical path, said alternate  
physical path comprising ones of said nodes with  
resources;

means for configuring said alternate physical path by  
 establishing a communication connection between said  
 ones of said nodes with resources; and  
 means for restoring said virtual path by provisioning said  
 5 virtual path over said alternate physical path.

114. The computer system of claim 113, further comprising:  
 means for detecting a failure in said virtual path by receiving a  
 failure message.

115. The computer system of claim 114, further comprising:  
 10 means for receiving a failure message packet;  
 means for acknowledging said failure message packet; and  
 means for determining said nodes with resources is done by  
 analyzing a response to said resource request packets.

116. The computer system of claim 114, wherein:  
 15 said virtual path is provisioned on a physical path between a  
 first and a second node of said optical network;  
 said physical path between said first and said second node  
 comprises a plurality of intermediate nodes;  
 said optical network comprises said nodes; and  
 20 each one of said nodes is coupled to at least one another of said  
 nodes by a plurality of optical links.

117. The computer system of claim 116, wherein each one of said nodes is  
 coupled to at least one another of said nodes in a mesh topology.

118. The computer system of claim 117, wherein said means for restoring of  
 25 said virtual path by is included in said first node.

119. The computer system of claim 118, further comprising:  
 means, if said failure is a local physical port failure between  
 said first node and an adjacent node, for  
 determining an available different physical port of said  
 link between said first node and said adjacent  
 nodes,  
 initiating a physical port switch request for said adjacent  
 node,  
 provisioning said virtual path to said different physical  
 port, and  
 updating said provisioning information in a node  
 database.

120. The computer system of claim 119, further comprising:  
 means, if different physical port of said link between said first  
 node and said adjacent nodes is unavailable, for  
 (i) changing a state of said virtual path to restoring,  
 (ii) identifying a plurality of adjacent nodes with  
 required bandwidth for said virtual path,  
 (iii) forwarding a path restoration request to said  
 plurality of adjacent nodes with required  
 bandwidth for said virtual path, and  
 (iv) waiting for a response for said path restoration  
 request for a first predetermined time interval.

121. The computer system of claim 120, further comprising:  
 if said response to said path restoration request is not received  
 within said first predetermined time interval,  
 means for repeating steps (ii) – (iv) for a second  
 predetermined time interval.

122. The computer system of claim 121, further comprising:  
means, if said response is not receive in within said second  
predetermined time interval, for  
generating network alarms.

123. The computer system of claim 119, further comprising:  
means, if said failure did not occur at a physical port of said  
link between said first node and one of adjacent nodes  
of said first node, for  
(i) changing a state of said virtual path to restoring,  
(ii) identifying a plurality of adjacent nodes with  
required bandwidth for said virtual path,  
(iii) forwarding a path restoration request to said  
plurality of adjacent nodes with required  
bandwidth for said virtual path, and  
(iv) waiting for a response for said path restoration  
request for a first predetermined time interval.

124. The computer system of claim 123, further comprising:  
if said response for said path restoration request is not receive  
within said first predetermined time interval,  
means for repeating steps (ii) – (iv) for a second  
predetermined time interval.

125. The computer system of claim 124, further comprising:  
means, if said response for said path restoration request is not  
received with in said second predetermined time  
interval, for  
generating network alarms.

126. The computer system of claim 117, wherein said restoring of said  
virtual path is performed by one of said intermediate nodes.

127. The computer system of claim 126, further comprising:  
means, if said failure is a local physical port failure between  
said intermediary node and an adjacent node comprising  
said virtual path, for  
5 determining an available different physical port of said  
link between said intermediary node and said  
adjacent nodes,  
initiating a physical port switch request for said adjacent  
node,  
10 provisioning said virtual path to said different physical  
port, and  
updating said provisioning information in a node  
database.

128. The computer system of claim 127, further comprising:  
means, if different physical port of said link between said  
intermediary node and said adjacent nodes is  
unavailable, for  
15 a. changing a state of said virtual path to down,  
b. generating a restoration request,  
20 c. forwarding said restoration request to a plurality of  
adjacent nodes comprising said virtual path, and  
d. waiting for a response to said restoration request for  
a predetermined interval of time.

129. The computer system of claim 128, further comprising:  
means, if said response to said restoration request is not  
25 received within said predetermined interval of time, for  
repeating steps (b) – (d) for a predefined threshold  
times.

130. The computer system of claim 129, further comprising:  
means, if said response to said restoration request is not  
received within said predefined threshold times, for  
releasing resources of said virtual path.

5 131. The computer system of claim 129, further comprising:  
means, if said response to said restoration request is received,  
for  
releasing resources of said virtual path.

10 132. The computer system of claim 126, further comprising:  
means, if said intermediary node receives a message of a  
remote port failure at a node comprising said virtual  
path, for  
changing a state of said virtual path to down,  
forwarding said message to a plurality of adjacent nodes  
15 comprising said virtual path, and  
initiating a timer for receiving a response to said  
forwarded message.

20 133. The computer system of claim 132, further comprising:  
means, if said timer expires before said response to said  
forwarded message is received, for  
releasing resources of said virtual path.

134. The computer system of claim 132, further comprising:  
means, if said response to said forwarded message is received,  
releasing resources of said virtual path.

135. The computer system of claim 126, further comprising:  
means, if said intermediary node receives a valid restore path  
request, for  
updating path information in a node database,  
allocating resources requested for said virtual path, and  
forwarding said restore path request to all eligible  
adjacent nodes.

136. The method of claim 126, further comprising:  
means, if said intermediary node receives an invalid restore  
path request, for  
responding with a negative acknowledgment.

137. The computer system of claim 117, wherein means for restoring of said  
virtual path is included in said second node.

138. The computer system of claim 137, further comprising:  
means, if said failure is a local physical port failure between  
said second node and an adjacent node comprising said  
virtual path, for  
determining an available different physical port of said  
link between said second node and said adjacent  
nodes,  
initiating a physical port switch request for said adjacent  
node,  
provisioning said virtual path to said different physical  
port, and  
updating said provisioning information in a node  
database.

139. The computer system of claim 138, further comprising:  
means, if different physical port of said link between said  
second node and said adjacent nodes is unavailable, for

- a. changing a state of said virtual path to down,
- b. generating a restoration request,
- c. forwarding said restoration request to a plurality of adjacent nodes comprising said virtual path, and
- d. waiting for a response to said restoration request for a predetermined interval of time.

140. The computer system of claim 139, further comprising:  
means, if said response to said restoration request is not received within said predetermined interval of time, for repeating steps (b) – (d) for a predefined threshold times.

141. The computer system of claim 140, further comprising:  
means, if said response to said restoration request is not received within said predefined threshold times, for releasing resources of said virtual path.

142. The computer system of claim 140, further comprising:  
means, if said response to said restoration request is received, for releasing resources of said virtual path.

143. The computer system of claim 137, further comprising:  
means, if said second node receives a message of a remote port failure at a node comprising said virtual path, for acknowledging said message, changing a state of said virtual path to down, and releasing resources of said virtual path.

144. The computer system of claim 137, further comprising:  
means, if said second node receives a valid restore path request, updating path information in a node database, and allocating resources requested for said virtual path.

145. The computer system of claim 137, further comprising:  
means, if said second node receives an invalid restore path  
request, for  
responding with a negative acknowledgment.

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